Model Takes the Guesswork Out of Fertilizing

A new Agricultural Research Service computer model could save farmers millions of dollars worldwide in soil test costs and wasted nitrogen.

Before year's end, the ARS Nitrogen Fertilizer Decision Aid will be posted on the World Wide Web for farmers, consultants, and anyone else who wants to use it.

Tested for 9 years with Minnesota corn farmers, the model helps eliminate uncertainties that lead many farmers to over-apply nitrogen in the spring. They add so-called "insurance fertilizer" to the amount called for by a fall soil sample, to compensate for possible nitrogen losses over the winter.

Alan E. Olness, a soil scientist, says the new model requires very little information from farmers planning to use it.

"Mostly the farmer needs to know only the clay and organic matter content of the top 6 inches of soil, as well as the soil pH and data from a field weather station," he says. "Then the farmer sends in soil samples to the usual state university or private lab for a Pre-Plant Soil Nitrate Test. This test is gradually gaining popularity because it's so accurate and useful."

Olness serves on the North Central Regional Committee that evaluated pre-plant and pre-sidedress tests on 307 sites in the north-central Corn Belt. One of the committee's goals is to facilitate more accurate nitrogen recommendations, to avoid waste, and to minimize possible nitrate pollution of groundwater.

The Pre-Plant Soil Nitrate Test solves the problem of estimating nitrogen losses over winter by sampling for nitrogen just before planting. The idea behind the test is this: Farmers can trust the test's analysis and apply only the amount of nitrogen the soil is lacking—if any—because they then follow up later with another soil test, in time to add more nitrogen if needed.

Olness says his model eliminates the need for the second soil nitrate test by predicting nitrogen content for up to 90 days after planting.

The model uses soil and weather information to predict how much nitrogen will be produced—after spring planting—by microbes. The microbes feed on soil organic matter and decaying plants, stalks, and leaves from the previous year's crop. In many soils, the microbes will naturally produce between 50 and 100 pounds of nitrogen per acre.

By adding this natural production to the amount measured at planting, the model tells farmers exactly how much nitrogen will be available to plants during the critical 60-day uptake period. The model subtracts this sum from the corn's total fertilizer need to recommend how much, if any, nitrogen fertilizer should be added for the best economic yield.

Olness says his model can also help farmers time the microbial production of nitrogen to meet plant needs at various growth stages.

Soil scientist Alan Olness and chemist Jana Rinke inspect corn plants in a tillage/nitrate study that helped show the accuracy of the Pre-Plant Soil Nitrate Test.

"They can slow down the rate by leaving crop residue on the surface and planting without tillage," says Olness. "Or they can till the soil first, to bury the residue and speed up the nitrogen production."—By **Don Comis,** ARS.

This research is part of Integrated Crop Production and Protection Systems, an ARS National Program (#305) described on the World Wide Web at http://www.nps.ars.usda.gov/programs/cppvs.htm.

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